

## Effect of Yoga on Lung Function Test

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### Abstract

**Background :** Yoga is an ancient Indian system and largest surviving philosophical system in the world. It is a novel and emerging discipline in broad category of mind-body medicine. Yoga, a spiritual discipline, induces positive health and its effect on lung function test can be used clinically as a therapeutic intervention in lung diseases like asthma. **Objective:** The study was conducted to assess the effect of yoga on dynamic lung volumes. **Results:** The lung function tests were conducted on 50 healthy male and female controls not practicing yoga in the age group of 30-50 years and sex and age-matched 50 healthy subjects practicing yoga for 5 years. The lung volumes recorded on electronic Medspiror were forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), maximum voluntary ventilation (MVV), peak expiratory flow rate (PEFR), forced expiratory volume in 3 seconds (FEV3) respiratory rate (RR) and breath holding time (BHT). The study demonstrates increase in FVC, FEV1, MVV, PEFR, FEV3 and breath holding time and decrease of respiratory rate in yoga performers. **Conclusion:** Yoga has a therapeutic value and doctor with yogic attitude is likely to transmit to the patient a positive attitude and calm disposition to achieve better results in healing various diseases with less medication.

### Key Words

Yoga, Lung Function Test, Lung Volumes

### Introduction

The word 'yoga' comes from Sanskrit word 'yuj' which means "union of mind with the divine intelligence of the universe".<sup>[1]</sup> It is one of the six orthodox Indian system of philosophy. In Bhagwat Gita, Lord Krishna explains to Arjuna the meaning of yoga as a deliverance from contact with pain and sorrow". Yoga is a channel by which restless mind is calmed and energy is directed into constructed channels. Modern man is the victim of stress-related disorders which threaten to disrupt life totally. Yogic lifestyle, yogic attitudes and various yogic practices help men to strengthen body and mind.<sup>[2]</sup>

Yogic asanas and breathing exercises improve muscle strength, flexibility, blood circulation, oxygen uptake that influences the static and dynamic lung

volumes. Yoga, in addition to asanas, involves controlled breathing (pranayama), voluntary concentration of thoughts (meditation) and repeated recital of phrases called mantras.<sup>[3]</sup> Pulmonary function tests provide quantitative and objective assessment of physiological derangement associated with pulmonary disease.

With much interest towards health benefits of yoga, the present study was conducted to assess the effect of yoga on lung function parameters in health.

### Material and Method

The present study was conducted on 50 controls, both males and females in the age group of 30-50 years

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not practicing yoga and sex and age-matched 50 subjects practicing yoga for 5 years. The subjects and controls with history of hypertension, diabetes mellitus, heart disease, tuberculosis and chronic pulmonary disease were excluded from the study.

**Yoga program:** Yoga was performed in Yoga Center at Bharatiya Yog Sanstha, Jammu in morning and evening session for one hour. In the session, the asanas were performed in first half-an-hour on rotation basis such as Suksham Kriya, Tadasana, Trikonasana, Surya Namaskar, Puranmuktasana, Shavasana, Hassi Kriya, Singhasana, Harasana, etc. In next 20 minutes, Pranayama was performed, followed by Dhyana and Shantipath for 10 minutes.

**Physical parameters:** The age was recorded in years, weight in kilograms and height in centimeters.

**Respiratory rate:** The subject was made to rest in lying position and frequency of breathing was noted by observing the abdominal wall movement for full one minute.

**Breath holding time:** The subject was asked to sit quietly for few minutes and breathe normally before breath holding was started. Then the nose was pinched, holding the breath after quiet inspiration and time was noted with the help of stop watch.

**Lung function test:** Lung function test of both subjects and controls were done with the help of Medspiror (Recorders and Medicare System, Chandigarh). The Medspiror is a computerized spirometer and is used with electromechanical pneumotech transducer supplied with the instrument. Only two parameters i.e. FVC and MVV were required to accumulate all necessary data. Two graphs lung volume and volume time graphs are also printed by the thermal printer of computerized Medspiror.

Before taking the record, the subjects were functionalized with the instrument and demonstration was given. Nose clip was used and sterilized. Mouth piece was pushed in transducer assembly for each subject.

**FVC test:** The subject was asked to inhale through the mouth piece forcefully after maximum inspiration. Four

**Table 1. Age and Sex Distribution of Subjects and Controls**

Age (in years)	Subjects (n=50)		Controls (n=50)	
	Males	Females	Males	Females
<or= 35	2	3	5	4
36 -40	10	9	10	8
41 - 45	7	5	8	6
46 - 50	11	3	6	3

component parameters i.e. FVC, FEV1, FEV2 and PEFR were displayed on LCD.

**MVV test:** The Medspiror was switched to MVV mode and the subject was asked to inhale and exhale through the mouth piece of transducer. The lung function tests studied were PVC, FEV, PEFR, MVV and PEV.

### Results

**Table 1** depicts the age distribution of the subjects and controls. Maximum number of subjects was in the age group of 41 to 45 years and minimum number of subjects was in the age group of <or =35 years.

**Table 2** depicts the distribution of the subjects and controls according to their BMI. No subject was having BMI >30 kg/m<sup>2</sup>.

The difference in the mean values of lung volumes of subjects and controls is statistically significant (p<.01). There is increase in FVC, FEV1, MVV, PEFR, FEV3 and BHT and decrease of respiratory rate in subjects.

### Discussion

Yoga is a system of philosophy established in India thousands of years ago. It seeks to develop the spiritual harmony of the individual through the control of mind and body. Breath holding time is crucial to the practice of yoga.

The interpretation of PFTs to diagnose respiratory diseases is built on expert opinion that relies on the recognition of patterns and the clinical context for detection of specific diseases.<sup>[9]</sup>

Our study of effect of yoga on lung function parameters demonstrates significant improvement in breath holding time, FVC, FEV1, FEV3, MVV and PEFR. The study demonstrates decrease in respiratory rate in subjects as compared to controls. Our results are similar to studies conducted by Vyas and Dikshit,<sup>[5]</sup> Sharma *et al.*,<sup>[6]</sup> and Kapoor *et al.*<sup>[7]</sup> Yoga guided relaxation techniques are associated with decreased oxygen consumption and increased breath volume - the clinical signs of neurohormonal activity.

The present study demonstrates significant increase in BHT in subjects and similar results have been noticed by Kapoor *et al.*<sup>[7]</sup> and Birkel and Edgren.<sup>[8]</sup> A few

**Table 2. Distribution of Subjects and Controls According to their BMI.**

BMI (kg/m <sup>2</sup> )	Subjects (n=50)		Controls (n=50)	
	No.		No.	
	Males	Females	Males	Females
<25	29	20	26	21
25-30	1	0	3	0

**Table 3. Lung Function Test of Subjects and Controls**

Lung volumes	Subjects (n=50)	Controls (n=50)	P-value
	Mean+/- SD	Mean+/- SD	
FVC	3.12 +/- 0.75	2.60 +/- 10.66	.0004*
FEV1	2.67 +/- 0.63	2.13 +/- 0.69	.0001*
PEFR	7.34 +/-2.56	6.40 +/- 2.37	.0002*
FEV3	3.12 +/- 0.76	2.60 +/- 0.67	.0004*
RR	15.74 +/- 3.06	20.22 +/- 1.57	.0001*
BHT	53.12 +/- 9.69	32.30 +/- 3.69	.0001*
MVV	103.72 +/- 40.46	79.40 +/- 25.71	.0001*

expulsions of Kapalbhathi (Kriya) before Pranayama clears the lungs, sinuses and nasal passages and increases the capacity to hold breath comfortably for longer time. In Pranayama, there is voluntary inhalation so that lung and alveoli are maximally stretched. The stretch receptors are trained to withstand more stretching, respiratory center is acclimatized to withstand high carbon dioxide in alveoli and blood and central and peripheral chemoreceptors are trained to tolerate increased carbon dioxide and decreased oxygen tensions through Pranayama. Yogic breathing through Pranayama improves will power and mitigates anxiety to improve breath holding time which is more psychological than physiological.

The study demonstrates increase in FVC in subjects which is in agreement with the studies conducted by Vyas and Dikshit, <sup>[5]</sup> Birkel and Edgren, <sup>[8]</sup> and Mauch and Day. <sup>[10]</sup> The increase in FVC is because of lung inflation to the total lung capacity during meditation which causes release of surfactant and prostaglandins into alveolar spaces leading to increase in lung compliance, decrease in bronchiolar smooth muscle and leading to increased expiratory release volume. In addition, asanas cause constant recruitment of thoracic muscles leading to improvement in vital capacity.

The present study demonstrates improvement in FEV1, which is in agreement with the studies conducted Yadav and Das, <sup>[11]</sup> Prakash *et al.* <sup>[12]</sup> and Sodhi *et al.* <sup>[13]</sup> Increase in FEV, is because forced breathing causes strengthening of respiratory muscles and improvement in elastic properties of lung and chest. Anulomvilom Pranayama i.e. alternate nose breathing increases the resistance which increases the strength of respiratory

muscle. The study demonstrates increase in FEV3 in subjects as compared to controls. Also, PEFR is significantly improved in subjects as compared to controls, which is analogous to studies conducted by Prakash *et al.* <sup>[12]</sup> Hadi and Hadi <sup>[14]</sup> and Vempati *et al.* <sup>[15]</sup> PEFR is an indicator of elastic recoil or resistance of small airways and its improvement is attributed to respiratory muscle conditioning after yoga.

The study demonstrates significant improvement in MVV in subjects and the same is analogous to the study of Sathyaprabha *et al.* <sup>[9]</sup> MVV is test for mechanical and flow resistive properties of the respiratory system and its improvement is due to strengthening of respiratory muscles because of regular practice of forced breathing. Pranayama & yoga breathing and stretching postures are used to increase respiratory stamina, relax the chest muscles, expand the lungs, raise energy levels, and calm the body. <sup>[16]</sup> Shruti *et al.* (2014) concluded in their research that in "the yoga group" significantly better improvement in spirometric variables occurred. The result shows that yoga can be an adjuvant therapy along with standard medical treatment for the better management of asthma patients. <sup>[17]</sup> Yoga regimen was found to improve lung functions and diffusion capacity in patients with Coronary artery disease besides improving cardiovascular functions by Yadav *et al.* <sup>[18]</sup> They concluded that it can be used as a complimentary or adjunct therapy along with the conventional medicine for their treatment and rehabilitation. Abel *et al.* <sup>[19]</sup> observed that pulmonary function appears to improve with a minimum of 10 weeks of regular yoga practice, and the magnitude of this improvement is related to fitness level and/or the length

of time the subjects spend practicing pranayama (i.e., breathing exercises). Brandani *et al*<sup>[20]</sup> in their systematic review found that lowering of BP- effect of pranayama is encouraging. The pranayama with slower rhythms and manipulation of the nostrils, present better results when compared with the other types and should be the main pranayama applied when the goal is to reduce blood pressure especially in hypertensive patients.

Modern man is the victim of stress and stress-related disorders, which threatens the life. The ancient Indian science yoga can be practiced as a healthy way of life. By practicing it a person reaches a state of mental equality so that responses to interval stresses are moderate and under control. The postures (asanas) tone, strengthen, align the body and make the spine supple to promote blood flow to all the organs, glands and tissues keeping all the systems healthy. Yoga is probably the best lifestyle devised in history. Its simple way of life causes strengthening of respiratory muscle, improvement in elastic properties and recruitment of thoracic muscles in respiration causing improvement in vital capacity. Its positive beneficial effect on respiratory system can be therapeutically used as an adjunct to medicinal treatment. Doctors should have knowledge about yoga and should gradually impart to the patient for treatment of diseases besides respiratory disease with less medication.

### Conclusion

Yoga, a rich treasure of physical and mental techniques, definitely has positive impact on respiratory system as demonstrated by our study. Its health benefits can be channelized and appropriately used for healthy lifestyle and for psychosomatic illness. One should incorporate yoga in his/her lifestyle for better results.

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### Conflicts of Interest

There are no conflicts of interest.

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